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Sept. 6, 1972
File 219

San Francisco Maritime Museum
Foot of Polk Street
San Francisco, California 94109

Attention: Mr. Karl Kortum, Director

SUBJECT: SURVEY REPORT - SAILING VESSEL "BALCLUTHA"

Ref. a) Kortum Ltr. to DJS dated July 18, 1972

Encl. 1) Report of Survey - Sailing Vessel BALCLUTHA
Dated August 25, 1972

Gentlemen:

In accordance with ref. a), I have com[illegible] subject survey and forward Encl 1) for your [illegible] on and file.

In summary, vessel's hull, spars and standing [illegible]ng are in good condition for service as a floating ma[illegible]e museum. Drydocking is not recommended at this ti[illegible]. Only critical areas of active corrosion found [illegible] inside walls of the main and mizzen topmasts, w[illegible] can be checked per procedures given under my recommenda[illegible]s.

I wish to thank Harlan Soeten, Jim Willia[illegible] and his crew for their kind assist during my survey ef[illegible]ts.

Very truly yours,

DAVID J. SEYMOUR

DJS/rb

REPORT OF SURVEY

Sailing Ship

BALCLUTHA

August 1972

for

San Francisco Maritime Museum

By

David J. Seymour
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REPORT OF SURVEY

Report No. 219 August 25, 1972

San Francisco Maritime Museum
Foot of Polk Street
San Francisco, California 94109

Attention: Mr. Karl Kortum, Director

Re: BALCLUTHA
Sailing Ship
244.5' x 19.2' x 25.3'

Gentlemen:

At your request, I, the undersigned, conducted a survey of subject vessel afloat at Pier 43, San Francisco, on Aug. 11, 14 and 15th, 1972.

The object of the survey was to determine condition of hull structure, masts and spars, standing rigging and major items of outfit. The results of the survey will be analyzed to establish any unsafe or hazardous conditions endangering visitors or vessel personnel, as well as, be used in preparing Maintenance and Repairs specifications and pricing.

It is noted from the records of subject vessel, that the following surveys and drydockings had previously been conducted.

Sept. 1, 1967 - Survey by Capt. J.M. Fitzsimmons, Watts and Co.

Mar. 2, 1966 - Drydock, Bethlehem Steel, Audiogage and Hull Repairs

Jan. 12, 1963 - Survey by Capt. J.M. Fitzsimmons, Pillsbury and Martignoni, Shell Damage by launch "Lark"

July 3, 1962 - Survey by Capt. J.M. Fitzsimmons, Pillsbury and Martignoni

Apr. 19, 1960 - Drydock, Bethlehem Steel, inclining, ballast, hull repairs, paint, new Fore Topmast

To systemetize reporting condition of vessel's parts surveyed and, to aid in progressing changes found at future surveys, "Midship Section & Shell Expansion Plan" (DJS Dwg. No. 219-1) and a "Spars & Standing Rigging Plan" (DJS Dwg. No. 219-2) were prepared. These were made from old drawings and ship checked for major dimensions and arrangements. Plating strakes were designated, frame numbers established (which were also marked on vessel) and masts, spars and rigging codified.

SURVEY FINDINGS

1. HULL STEEL - (See Appendix No. 1 - DJS Dwg. No. 219-1 "Midship Section and Shell Expansion").

A. Exterior - the general condition and maintenance of shell plating above waterline was found in satisfactory condition for a vessel of this age, type and service as a floating museum.

Heavy pitting on side plating and sheer strake was noted, however it was obvious that such occurred years ago and that corrosion action has been arrested by present coating, which is holding up in excellent condition.

Some minor areas of flaking rust were observed, particularly amidships in G strake, port side, Fr. 40-50, above the 1960 installed steel doubler on F strake. As for F strake (landing strake), some general rusting and growth was found but no serious condition existed.

The exterior underwater portion of bottom shell, of course, was not sighted with vessel afloat.

B. Interior - the general condition and maintenance of steel structure and plating was found satisfactory with practically all steel and iron surfaces covered with well bonded paint or Eureka Fluid.

The extensive rust laminations of shell longitudinal stringers, Frames 30 to 95, P&S, appeared to have been arrested with red lead paint. The new reinforcing angles below stringers were in excellent condition.

Some areas of the shell plating, floors and Keelsons were found bare where Eureka Fluid had flaked off, together with layers of rust. However, in most of such areas the steel was found only slightly rusted or not rusted at all.

In general shell bottom plating and rivets, as inspected from interior, appeared sound and in good condition with no signs of active corrosion, plate wastage or leaks.

C. Conclusions & Recommendations - the condition of vessel's hull structure, including steel shell plating, deck stringer and tie plates, frames, floors, Keelsons, deck beams and iron stanchions are in excellent condition for a vessel of this age. Level of maintenance is good and no active or accelerated corrosion action, endangering the principal scantlings, was found. Several minor areas of rust were noted, however on the majority of steel surfaces, the protective coatings were found intact and in sound condition.

Per audiogagings of 1966, the vessel's original plate thickness and present visual inspection, there does not appear to be any valid reason for drydocking vessel at this time. The only obvious area requiring maintenance on shell is the"wind and water strake" (new F strake doubler). To maintain this area without drydocking, vessel could be listed with weights to expose plating for cleaning and coating.

With vessel's static condition, there is no evidence to indicate that bottom anti-corrosion paint is not intact.

It is suggested that an ultrasonic test program of underwater plating be conducted at three year intervals.

This can be done from within vessel or from without with divers.

It is recommended that good maintenance be continued as to interior bottom shell, bare steel areas, where Eureka Fluid has flaked off should be scraped clean and recoated with same fluid coating.

2. MASTS & RIGGING

A. General - masts, yards and standing rigging were surveyed primarily for the purpose of determining the adequacy of the steel, wood and fitting material to properly and safely support these structures.

To facilitate identifying and recording of spars and rigging parts, a simple coded system was developed which is hoped will assist in recording and progressing masts and rigging conditions for this and future periodic surveys. (See Appendix No. 2)

The masts, yards and standing rigging, when found to meet the requirement for safely supporting their structure, were recorded as being in "good condition". It should be emphasized that this in no way means suitable for seagoing or operating conditions under sail as a full rigged ship, but rather only as a permanently moored floating maritime museum.

B. Conclusions & Recommendations - in general the masts, yards and rigging were found in "good condition" except for the Main Topmast and the Mizzen Topmast, which are explained in detail below. For details of the other areas of deficiencies, as noted in Appendix No. 3, are relatively minor and can readily be repaired, corrected or maintained by vessel's manager and crew.

i) Main Topmast Corrosion

There exists a serious condition of corrosion on the inside section of the topmast from just below the futtock shroud band to the mast band, a length of about 20 feet. Corrosion holes (as well as rivet

holes) and corrosion fatigue cracks originating from the inside mast wall were noted. This general condition was mentioned by Capt. Fitzsimmons in his last two surveys and is obviously progressing at a rapid rate.

The cause for this condition is rain water and moisture entering from the loose topmast cap and sheave opening for upper topsail yard chain halyard. (Note: on new fore topmast a sealing diaphragm plate was installed just below the halyard sheave to stop entry of rain water). With a rake of about 3 degrees of the mainmast, this water concentrates wetting action in the internal aft side of the mast. This wetting and drying cycle accelerates corrosion.

With the diameter of the mast at about 24 inches in this region and $\frac{1}{2}$ inch in thickness, there remains considerable margin of strength of mast wall in compression to support vertical loads. The weak direction will develop in forward bending of mast which is unlikely with stays and backstays maintained in proper alignment and adjustment of tension.

It is recommended that the mast be sealed off from entry of rain water by making cap watertight, closing up sheave openings and, stuffing rivet and corrosion holes with plugsaft side of mast.prior to sealing it. An anti-corrosion fluid should be poured down the inside of the mast prior to sealing it. At next drydocking this section of topmast should be fitted with a reinforcing doubler over corroded area as a permanent fix with a permanent diaphragm plate inserted below halyard sheave.

ii) Mizzen Topmast Corrosion

The same condition exists on the mizzen topmast section, just below the doubler plate and the same recommendations apply as given for the main topmast.

3. OUTFIT

A. Pumping System - it was noted that vessel, by the collision bulkhead, is divided into only two watertight compartments, namely the Fore Peak and the Hold.

In the Fore Peak, a small domestic automatic sump pump ($\frac{1}{2}$ HP - 500 gpm) was noted which took suction from this compartment to an overboard at the Tween Deck Level. Discharge head of about 20 ft. would reduce gpm to about 100 gpm.

For the vessel's Hold (remaining hull volume) the Main Hand Pump, located on Main Deck aft of mainmast, was noted with an estimated capacity of about 100 gpm. Limber holes were observed in all floors to permit drainage of flooding water to the sump area for this pump.

In view of vessel's permanent mooring, there exists a low probability of being rammed, holed, scuttled or sunk by accidental means. In addition, vessel's berth is relatively shallow so that sinking would result in resting on the mud bottom with a 7 degree list (angle of her deadrise), with her Main Deck above water.

It is recommended, although not mandatory, that a high capacity portable salvage pump (500 gpm) be maintained in standby condition on board to adequately handle a flooding condition in lieu of utilizing the old existing Hand Pump.

B. Electrical System - the shore power main, 45 KVA Transformer and Main distribution panel installation appeared properly installed and in good condition.

However, it was noted that the power and lighting distribution system on board vessel contained many obvious violations of good electrical code and practice and presents hazards to personnel, as well as, a source for fire namely:

i) Electrical Cable passing through steel decks without reinforcing collar or bushing pieces.

ii) Pipe Conduit with nontight joints and improperly supported.

iii) Use of long lengths of domestic electrical cords for 150 W spots.

iv) Overheating of 150 W spots with improper shades.

v) Armored cable leading to spotlights on masts hanging and chafing against steel masts.

vi) No electrical diagram or load analysis to determine if electrical system within safe limits or overloaded.

It is suggested that an electrical engineer survey total electrical system, prepare a One Line Electrical Diagram, calculate load conditions and make recommendations for corrections.

C. Mooring, Gangways & Decks - the mooring arrangement was found in good condition and suitable to accommodate vessel's motion in heaving and from tidal range.

The boarding gangway and between deck stairways were found in good condition, with proper safety treads, hand railings, lighting and warning signs.

The wood decks, newly installed and original sections, were found in good condition. It was noted that some leaks existed in the Main Deck Frames 60 to 90 when washing down, however corrective maintenance by crew can handle this problem.

D. Cathodic Protection - the feasibility of installing a cathodic protection system for the BALCLUTHA has been investigated.

Basically a cathodic protection system is used to eliminate the electrochemical process of corrosion. A ship's hull sets up a multitude of galvanic cells when it is immersed in an electrolyte such as sea water. These galvanic cells form at different parts of the hull, some being "anodic" and some "cathodic". Since an electrical potential difference exists, (for dissimilar metals this value is much greater) between these areas, electric currents

are generated passing out of the steel at the "anodic" areas (thus losing metal and corroding), flow through the water and, re-enter the steel at the "cathodic" areas which do not corrode. The galvanic circuit is completed when the current passes back to the anodic areas through the steel plating.

To prevent corrosion, the anodic areas of the steel are eliminated by fitting the hull with special anodes. Since current now leaves these special anodes, instead of the steel, corrosion is prevented.

Two types of anodes are available:

1) Sacrificial Type

These are usually of zinc or magnesium alloy which are attached to under water portion of the hull. They protect the hull by wasting away instead of the steel material. However, they must be replaced at each drydock interval.

2) Impressed Current Type

Permanent anodes (usually 4) of platinized titanium are fixed to the hull and are capable of passing current into the water from low voltage generator equipment within the ship. The correct amount of electrical current, controlled by a reference electrode, depends on the ship's speed, draft, water salinity, temperature, type and condition of coating, etc. This automatic system is able to accommodate wide excursions in electrical potentials which the sacrificial type cannot. Practically all new large vessels have this type installed since it has proven more economical.

A type of impressed current system (similar to STAR OF INDIA) is manufactured by LOCKHEED AIR SERVICE Division. This type employs anodes suspended in the water at the ends of the vessel. Costs for such a system installed would be about $8000 to $10,000.

In the case of the BALCLUTHA, a cathodic protection system is not considered necessary because:

a) Vessel is in stationary position - electrical potential differences very small.

SPECIFICATIONS

FOR

REPAIRS TO MAIN & MIZZEN TOPMAST

Of

Sailing Ship BALCLUTHA

For

San Francisco Maritime Museum

By

David J. Seymour
NAVAL ARCHITECTS-MARINE CONSULTANTS
WORLD TRADE CENTER - SUITE 330
EMBARCADERO AT MARKET
SAN FRANCISCO, CAL. 94111

November 8, 1972

INTENT

It is the intent of these specifications and attached plan to describe the work necessary to repair the corroded sections of the Main and Mizzen Topmast of the Sailing Ship BALCLUTHA. Repairs shall restore corroded portions of these Masts, prevent further corrosion action and, be done in such a manner as to retain as much as possible the authenticity of vessel's original design and construction.

DEFINITIONS

The following terms appearing in these specifications shall be interpreted as follows:

Owner: Vessel's Owner - San Francisco Maritime Museum

Owner's Design Agent: David J. Seymour, Naval Architect & Marine Consultant, San Francisco, California

Contractor: Successful bidder having responsibility to perform repair work

GENERAL

The Contractor shall provide all necessary tools, material, equipment and labor to accomplish the repair work described herein.

The repair work shall be performed on subject vessel while afloat, starboard side, Pier 41, Embacadero, San Francisco.

Access to vessel by truck vehicle is available from pier side and by floating craft from the port or offshore side.

CONTRACT PLANS

The following Contract Plan is part of these specifications.

DJS Dwg. No. 227-1, Alt. 0, "BALCLUTHA - Repairs to Main & Mizzen Masts"

For guidance purposes the following plan is referred to:

DJS Dwg. No. 219-2, Alt. 0, "BALCLUTHA - Spars & Standing Rigging"

DESIGN AND REPAIR STANDARDS

Since vessel is currently a "Floating Maritime Museum", no classification standards or certification standards are invoked.

However, Contractor shall furnish all material and accomplish work in accordance with the Contract Plan, good ship repair practices and, using American Bureau of Shipping Classification design standards as guidance.

In addition, Contractor shall accomplish all work so as to retain, as far as practical, the original authenticity of design and construction for vessels of this type built in the era of 1865. All detail methods of repairs proposed by the Contractor shall be approved by Owner's Design Agent prior to commencement of work.

DESCRIPTION OF REPAIRS

The Contractor shall furnish all equipment, tools, materials and labor to accomplish the following repairs:

1. Main Topmast

   The Main Topmast Section has extensive corrosion on the after inside walls of the Mast. Source of corrosion is entry of rain water and moisture through opening for the halyard sheave, located just below the futtock shroud band. The object of repairs is to seal off hollow portion of the Mast below the sheave, renew wasted section of Mast wall and plug weld all openings as shown on DJS Dwg. No. 227-1 and itemized as follows.

   A. Topmast Seal Plate - install a new watertight diaphram plate just below halyard sheave.

   B. Repair Sprung Doubler - fair and weld sprung doubler located just below futtock shroud band.

   C. New Insert Plate - cut out corroded section and weld in new flush insert plate.

   D. Plug Weld Holes

   E. Repair Sprung Rivet Seam - fair and weld similar to Item B.

2. Mizzen Topmast

The Mizzen Topmast Section has similar corrosion condition as the Main Topmast Section. Repairs shall be of similar nature and itemized as follows.

A. Topmast Seal Plate - same as Mainmast

B. Plug Weld Holes

C. Repair Hole 1"x4" - install welded insert plate, grind welds

D. Repair Hole $1\frac{1}{2}$"x$3\frac{1}{2}$" - install welded doubler to cover hole

The foot of both Masts are presently open and shall be retained open for normal breathing of void space within the Masts.

COATINGS

1. Interior Mast Walls

Contractor shall apply a rust prohibitive coating to interior wall surfaces of both Top Masts. Coating shall be of Carboline Ballast Cote 5. No cleaning or removal of rust shall be required. It is suggested that a portable plug with brushes be used for application of coating.

2. Exterior Mast Walls

Upon completion of all welding, Contractor shall thoroughly clean exterior steel surfaces of Mast walls by machine wire brushing and apply an approved primer coat and two finish coats to match existing Mast colours.

MATERIALS

Existing Mast plating of Topmasts is believed to be of mild steel. New steel and welding rod shall be mild steel (ASTM A-7). ABS Classification steel shall not be required.

METHOD OF ACCOMPLISHING REPAIRS

To accomplish repairs, two possible methods are considered:

1. Install steel scaffolding around Main and Mizzen Mast to upper platform level, approximately 100 feet above vessel's Main Deck.

2. Employ Truck Crane with boom of sufficient length to support a working platform from which to undertake repairs.

   Contractor shall have the option of offering an alternative method from above, after viewing vessel, in submitting his bid.

   Any method selected and approved for repairs shall not utilize or rely on vessel's existing mast structure or her standing rigging to support weights of staging, heavy equipment or tools.

   Prior to removal of corroded section of Main Topmast, Contractor shall slacken stays, per Contract Plan, to maintain proper alignment of Mast during repairs.

   Also Contractor shall advise what areas of vessel's Main Deck shall be restricted from access by visitors, or whether visitors should be restricted from boarding during period of repair work.

INSURANCE

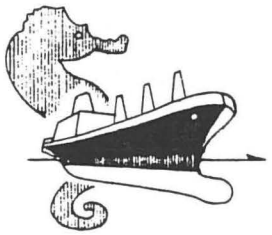
Contractor shall carry standard Ship Repair Liability Insurance and Comprehensive Liability Insurance, with $300,000 combined single limit, naming San Francisco Maritime Museum as an additional insured under such policy.

INSPECTION AND APPROVAL

All material and workmanship shall be subject to inspection and approval of Owner's Design Agent.

GUARANTEE PERIOD

The Contractor shall guarantee for a period of six (6) months, all workmanship and materials furnished by him or his sub-contractors.



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Telephone (604) 685-8394

October 30, 1972
File No. 227

San Francisco Maritime Museum
Foot of Polk Street
San Francisco, Calif. 94109

Attention: Mr. Karl Kortum, Director

SUBJECT: SPECIFICATIONS FOR MAST REPAIRS
SAILING VESSEL "BALCLUTHA"

Ref. a) Telecon H. Soeten to DJS Oct. 27, 1972
b) DJS Survey Report S.S. BALCLUTHA dated Aug. 25/72

Gentlemen:

This will confirm your authorization, given per ref. a), for preparation of specifications and bidding material for repairs to subject vessel's main and mizzen topmasts, including review of bids, inspection and approval of work. Repairs will correct conditions of mast corrosion, as found under ref. b).

It is also agreed that my fee for above services shall be $500.00

Very truly yours,

DAVID J. SEYMOUR

DJS/rb

SURVEY REPORT AUGUST 1972

APPENDIX NO. 3

DETAILS ON CONDITION
OF SPARS & RIGGING

MASTS

BALCLUTHA

SURVEY REPORT

DATE August 15, 1972

*See DJS Dwg. No. 219-2

CODE*	MAST	SECTION	REMARKS
M_F (1)	Fore	Housing	Good Condition - small pile rust below heel - well maintained
(2)	"	Lower Mast	Good Condition - well maintained - Platform cheek plates heavy corrosion
(3)	"	Topmast	Topgallant Shroud band rust behind spot welds - New steel O.K. slight rust
(4)	"	Topgallant	Good Condition - wood checked - slight rot in heel - staybands and paint O.K.
(5)	"	Royal	Good Condition - wood checked paint O.K. - Bow fwd slightly due S_F (6) taut
(A)	"	Partners	Good Condition - some areas slight rust
M_M (1)	Main	Housing	Good Condition- welded heel chocks O.K. Large pile rust & bird nest below heel
(2)	"	Lower Mast	Good Condition - some rust spots - corroded at futtock shroud pads
(3)	"	Topmast	Serious Condition - internal corrosion - See Details
(4)	"	Topgallant	Good Condition - wood checked - paint O.K. slight fwd bow due S_M (3)
(5)	"	Royal	" " - " " - " " .
(A)	"	Partners	" " - some areas slight rust
M_{MZ} (1)	Mizz	Housing	Good Condition - small pile rust below heel - well maintained Futtock Shroud Pads rusted top edge of faying surface
(2)	"	Lower Mast	Cap Loose & Rusted - doubler plate corroded & pitted - O.K. Mast bowed above doubler
(3)	"	Topmast	Trestle Trees rusted - mast corroded - See Details
(4)	"	Topgallant	Good Condition - wood check - paint O.K.
(5)	"	Royal	" " - " " " "
(A)	"	Partners	" " - some areas light rust

BALCUTHA

YARDS & FITTINGS — SURVEY REPORT — DATE August 15, 1972

CODE	MAST	YARD	REMARKS
Y_F (1)	Fore	Fore	Good Condition
(2)	"	Lower Topsail	" "
(3)	"	Upper "	" " - Truss Band Eye Bolts corroded - halyard chain not stretched - adjust chain position to eliminate concentrated corrosion
(4)	"	Topgallant	" "
(5)	"	Royal	" "
Y_M (1)	Main	Main	Good Condition
(2)	"	Lower Topsail	" " - Corrosion Holes Outer end Port
(3)	"	Upper "	" " - Lowered to above Lower Topsail Yard
(4)	"	Topgallant	Not in Place
(5)	"	Royal	Not in Place
Y_{MZ} (1)	Mizz	Crojack	Good Condition
(2)	"	Lower Topsail	Not in Place
(3)	"	Upper "	Good Condition
(4)	"	Topgallant	Not in Place
(5)	"	Royal	Not in Place

BALCUTA

BOOMS & FITTINGS — SURVEY REPORT — DATE August 15, 1972

CODE	DESCRIPT.	REMARKS
B (1)	Bowsprit	Steel Spike - Good Condition - interior slight rust - O.K.
B (2)	Spanker Boom	Rot around Pacific Iron - remainder O.K.
B (3)	" Gaff	Good Condition
B (4)	Dolphin Striker	Iron Rod and fittings-Good Condition

SHROUDS & FITTINGS (Including wire, coating, serving, bolsters, seizing, bottle screws, sheer poles and chain plates)

SH_F (1)	Lower Mast	Good Condition - sheer poles found missing, wire substituted
(2)	Topmast	" "
(3)	Topgallant	" "
SH_M (1)	Lower Mast	Good Condition - sheer poles found missing, wire substituted
(2)	Topmast	" "
(3)	Topgallant	" "
SH_{MZ} (1)	Lower Mast	Good Condition - sheer poles found missing wire substituted
(2)	Topmast	" "
(3)	Topgallant	" "

STAYS
(Including wire, coating, serving, bolsters and fittings)

SURVEY REPORT

DATE August 15, 1972

CODE	MAST	DESCRIPT.	REMARKS
S_F (1)	Fore	Lower Mast (6)	Good Condition
(2)	"	Topmast	" " - slightly slack
(3)	"	Jib	" " - " "
(4)	"	Outer Jib	" " - " "
(5)	"	Topgallant	Slightly worn - good maintenance O.K.
(6)	"	Royal	Good Condition - slightly taut
S_M (1)	Main	Lower Mast (4)	Good Condition - slightly slack
(2)	"	Topmast	" " - " "
(3)	"	Topgallant	" " - " "
(4)	"	Royal	" " - " "
S_{MZ} (1)	Mizz	Lower Mast (6)	Good Condition - slightly slack
(2)	"	Topmast	" " - " "
(3)	"	Topgallant	" " - " "
(4)	"	Royal	" " - slightly plus slack
S_B	Bows-prit	Bobstay	Good Condition - iron rod and fittings
S_{OB}	"	Outer Bobstay	" " - " " " "

BALCUTHA

BACKSTAYS
(Including wire, coating, fittings and spreaders)

SURVEY REPORT

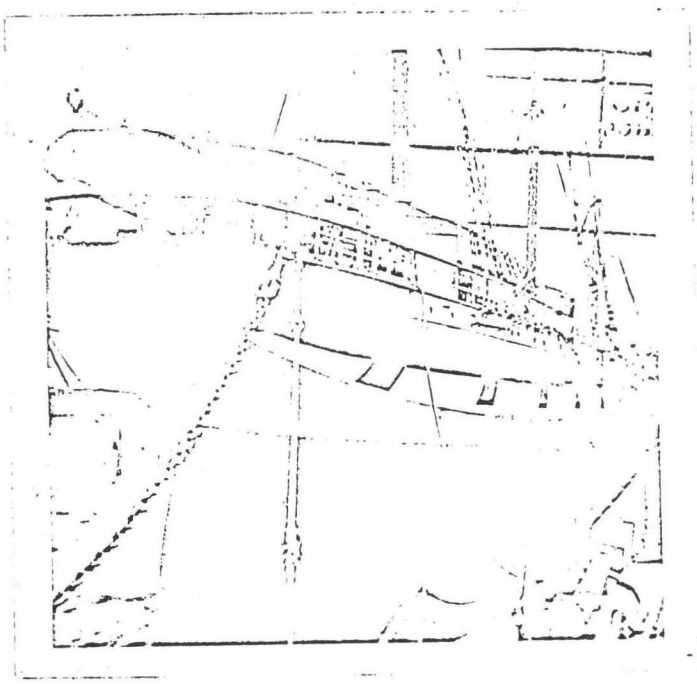
DATE August 15, 1972

CODE	MAST	DESCRIPT.	
BS_F (1)	Fore	Topmast (3)	Good Condition - slightly slack
(2)	"	Topgallant (2)	" " " "
(3)	"	Royal (1)	" " " "
(4)	"	Spreaders	Good Condition
BS_M (1)	Main	Topmast (3)	Good Condition
(2)	"	Topgallant (2)	" "
(3)	"	Royal (1)	" "
( )	"	Spreaders	" "
BS_{MZ} (1)	Mizz	Topmast (3)	Good Condition - serving worn, bolsters slightly crushed
(2)	"	Topgallant (2)	" "
(3)	"	Royal (1)	" "
(4)	"	Spreaders	" " stbd spreader bent
BS_M A	Main	Mid Topmast	" "

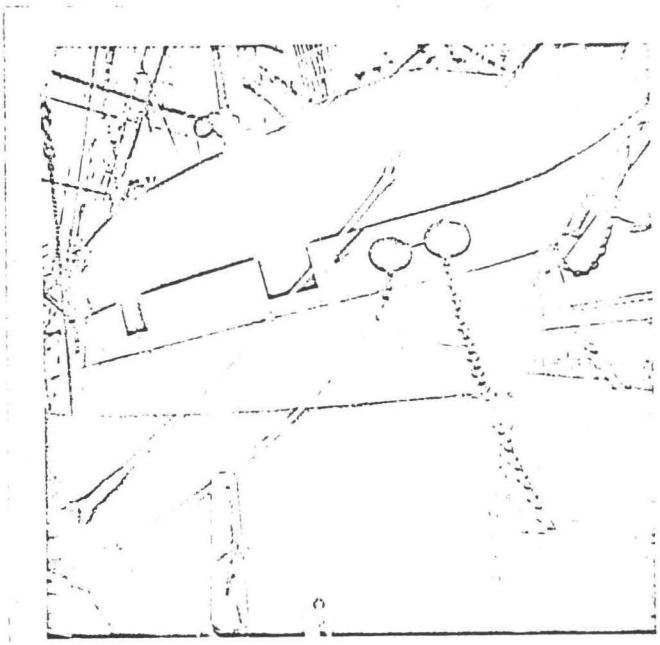
SAILING SHIP

"BALCLUTHA"

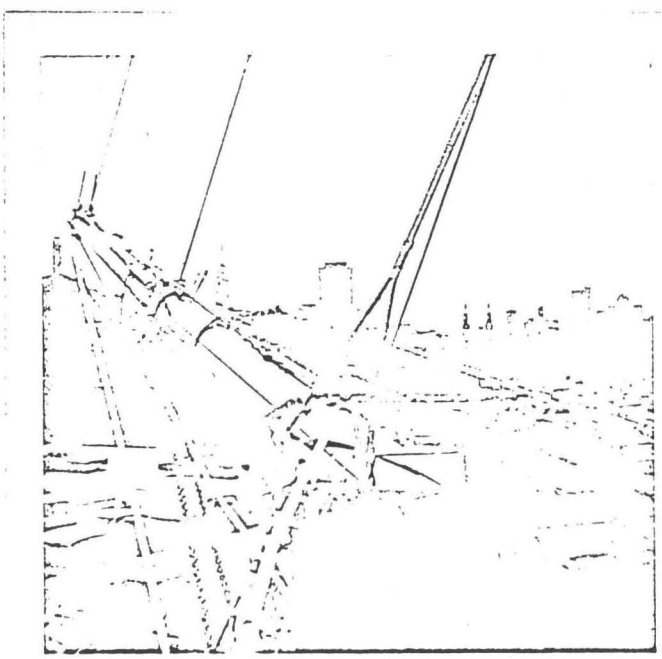
SURVEY AUG., 1972



STERN VIEW



BOW VIEW



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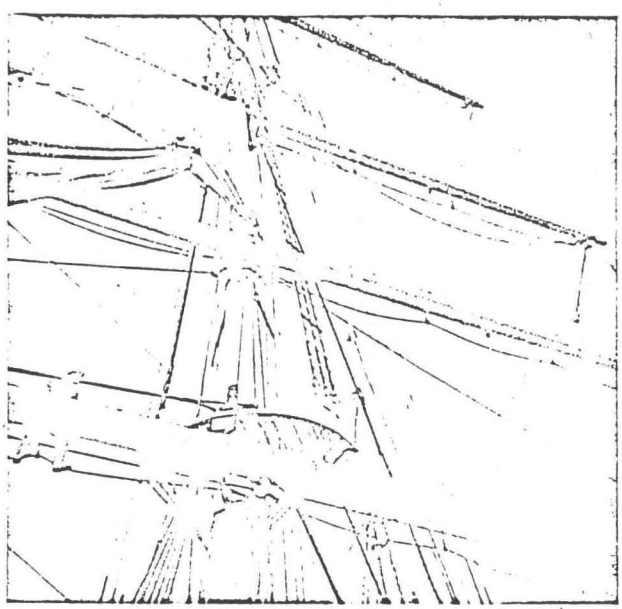
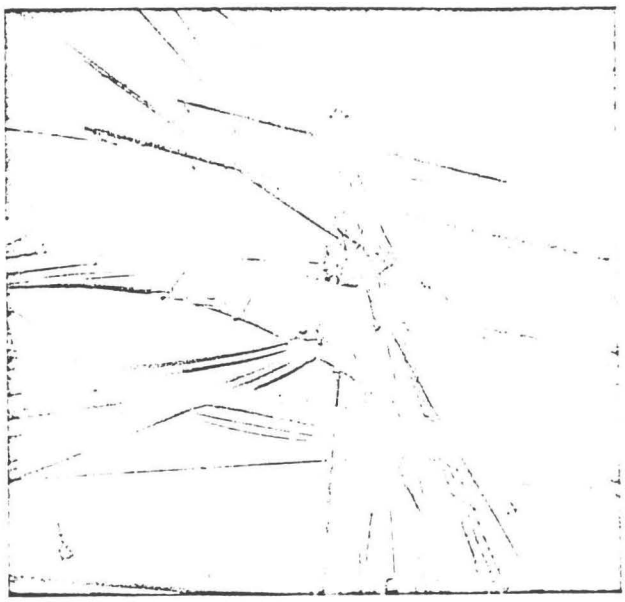
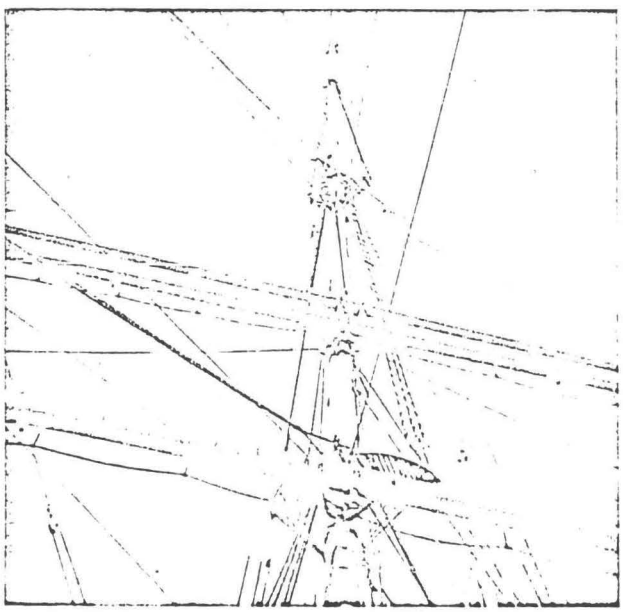
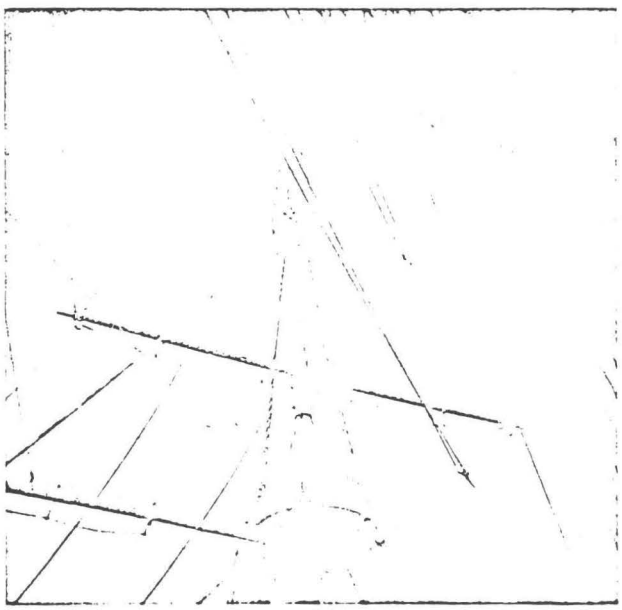




FOREMAST





MAIN MAST

MIZZEN MAST